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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/791,247	03/01/2004	Chun-Hsien Lin	67,200-1130	2810

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EXAMINER	
CHAUDHRY, SAEED T	

ART UNIT	PAPER NUMBER
1746	

MAIL DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/791,247	LIN, CHUN-HSIEN	
	Examiner	Art Unit	
	Saeed T. Chaudhry	1746	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3,7-13,17 and 19-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3 7-13 17 19-26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Applicant's amendments and remarks filed April 25, 2007, 2004 have been acknowledged by the examiner and entered. Claims 4-6, 14, 16 and 18 have been canceled and claims 1-3, 7-13, 15, 17 and 19-26 are pending in this application for consideration.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1-3, 7-13, 17 and 19-26 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claims 1, 13 and 17 claims a limitation "non-supercritical", which introduces new matter in the claims. Applicant has not pointed out where the amended claims are supported, nor does there appear to be a written description of the claim limitation "non-supercritical" in the application as filed (see in re Gilbert P. Hyatt v Jon W. Dudas (Fed Cir, 2006-1171, 6/28/2007).

New ground of rejection
Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in Graham v. John Deere Co., 148 USPQ 459, that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or unobviousness.

Claims 1-3, 7-9 and 21 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Inoue et al.

Inoue et al (6,962,161) disclose a method of removing an unnecessary substance on a surface of a work piece by mixing solvent in a mixing chamber (15) and introducing the mixture in the processing chamber to form supercritical fluid of the mixture.

A method of removing unnecessary materials such as resist and so on stuck onto a surface of a substrate in a semiconductor manufacturing process off the substrate and removing therefrom. In a third stage, high-pressure processing such as cleaning and so on is performed. The third stage includes mixing and dissolving the additives, the co-solvent and carbon dioxide; and processing such as the cleaning and the like. First, when the second stage has come to completion, the high-pressure valve 10 is closed, and the high-pressure valves 5 and 13 are opened. Furthermore, from a additives and co-solvent storage tank 11 that reserves the additives and co-solvent, by use of a pump 12, a mixture of the additives and co-solvent is allowed to merge into a carbon dioxide supply line (merging point 14). Subsequently, by going through mixing unit 15, the additives and co-solvent are dissolved in carbon dioxide, and thereby a homogenous dissolution state can be obtained. This is the mixing and dissolving process. The mixture, if necessary, is heated again by a heater 16 and supplied to the high-pressure processing chamber 2. The heater 16 is used when owing to mixing of the additives and co-solvent, a temperature of carbon dioxide is lowered and thereby the supercritical state disappears.

Subsequently, the high-pressure processing such as cleaning and so on is carried out. When the mixture fluid of carbon dioxide, additives and co-solvent is supplied to the high-pressure processing chamber 2, the high-pressure valve 5 is controlled so that a pressure in the high-pressure processing chamber 2 is a pressure same as that of the second stage. Specifically, the high-pressure fluid of an amount substantially same as that of the mixture fluid supplied into the high-pressure processing chamber 2 is extracted from the high-pressure processing chamber 2, and thereby a pressure in the high-pressure processing chamber 2 is maintained at a constant value.

As the third stage is continuously carried out, supercritical carbon dioxide therein the additives and the co-solvent are homogeneously mixed and dissolved is supplied constantly in a clean state to the high-pressure processing chamber 2 and comes into contact with a surface of the workpiece 3 such as wafers. Then, unnecessary materials are dissolved from a surface of the workpiece 3 into a cleaning fluid and removed. The high-pressure fluid that is contaminated by dissolving the unnecessary materials, without remaining in the high-pressure processing chamber 2, is exhausted from the high-pressure processing chamber 2. Accordingly, the third stage that performs the cleaning and so on can be carried out stably and in a short period of time.

Here, as the additives, fluorides can be preferably used in order to remove also polymer contaminants such as resist and etching polymer stuck to a semiconductor substrate. Fluorides very thinly dissolve a surface of the workpiece 3, and, owing to a lift off effect, unnecessary materials on a surface of the workpiece 3 are excellently removed.

As specific examples of the fluoride, ammonium fluoride (NH_4F), quaternary ammonium fluorides containing nitrogen atom and hydrogen atom such as tetramethylammonium fluoride, tetraethylammonium fluoride, tetrapropylammonium fluoride, tetrabutylammonium fluoride, and choline fluoride $[HOCH_2\ CH_2\ N(CH_3)_3\ ]^{+F}$ can be cited. The fluorides have excellent cleaning power. Depending on the kind of the workpiece, fluorides further containing carbon atom (for instance, among the above cited compounds, compounds other than ammonium fluoride) are more effective. Polyalcohols such as polypropylene glycol may be used as the additives together with the fluorides.

Depending on the kind of the workpiece and the kind of the unnecessary material, the kind of the additives may be altered; quaternary ammonium hydroxides such as TMAH (tetramethylammonium hydroxide), alkylamines, alkanolamines, hydroxylamines (NH.sub.2 OH), xylenes, methylisobutyl ketones and fluorinated polymers may be used as the additives.

The additives can be dissolved with difficulty in supercritical carbon dioxide; accordingly, by using in combination a co-solvent that can be a dissolution auxiliary, a homogeneous cleaning fluid (mixture fluid of the additives, the co-solvent and carbon dioxide) can be obtained. Although the co-solvents are not restricted to particular ones as far as the additives and supercritical carbon dioxide are made compatible, aliphatic alcohols, in particular, aliphatic alcohols having one to three carbons such as methanol, ethanol, isopropanol and so on can be preferably cited. This is because that these substances dissolve easily in supercritical carbon dioxide; accordingly, by controlling an addition amount thereof, the cleaning power can be controlled. One kind or two or more kinds thereof may be mixed and used (see col. 5, line 9 through col. 6, line 26).

It would have been obvious at the time applicant invented the claimed process to use cleaning fluid such as Carbon dioxide and a solvent such as methanol, ethanol, isopropanol, ammonium fluoride and polypropylene glycol mixture in supercritical state for cleaning a substrate as disclosed by Inoue et al. Further, Inoue et al disclose "from a additives and co-solvent storage tank 11 that reserves the additives and co-solvent, by use of a pump 12, a mixture of the additives and co-solvent is allowed to merge into a carbon dioxide supply line (merging point 14). Subsequently, by going through mixing unit 15, the additives and co-solvent are dissolved in carbon dioxide, and thereby a homogenous dissolution state can be obtained. This is the mixing and dissolving process. The mixture, if necessary, is heated again by a heater 16 and supplied to the high-pressure processing chamber 2. The heater 16 is used when owing to mixing of the additives and co-solvent, a temperature of carbon dioxide is lowered and thereby the supercritical state disappears" (see col. 5, lines 19-27). Therefore, Inoue et al disclose that the mixture is non-supercritical state after mixing in the mixing chamber (15). One of ordinary skill in the art would mix the cleaning fluid and solvent in non-supercritical state and then change the mixture into a supercritical state for cleaning the substrate in the chamber.

Furthermore, Inoue et al disclose that "the additives and the co-solvent can be supplied through separate supply lines to a carbon dioxide supply line; however, it is preferable that the additives and the co-solvent are mixed in advance and supplied to carbon dioxide. Furthermore, it is also preferable mode to dispose mixing unit 15 between the merging point 14 and the high-pressure processing chamber 2, and thereby uniformly dissolving the mixture of the additives and the co-solvent and carbon dioxide. In the case where the additives or the co-solvent is not

uniformly dissolved in carbon dioxide, the additives and co-solvent are contained as fine droplets in carbon dioxide. When such droplets come into contact with a surface of the workpiece 3, there are concerns in that troubles such as the workpiece 3 being locally destroyed and the processing such as the cleaning being nonuniformly applied might be caused. Accordingly, these three components are preferable to be mixed and dissolved homogenously" (see col. 6, line 27-43). Therefore, one of ordinary skill in the art would have mix the solvent and the cleaning fluid in a non-supercritical state since mixing in the supercritical state is difficult and cleaning being nonuniformly applied to the substrate. It is well known in the art to circulate the cleaning solution in the chamber to reach every components of the substrate. Therefore, one would use a circulating step for exposing all the components of the substrate and remixing the solution in the chamber.

Claims 10-13, 15, 17, 19-20 and 22-26 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Inoue et al in view of Morita et al and Vaartstra et al.

Inoue et al were discussed supra. However, the reference fails to disclose cleaning conductor and conductive layer.

Morita et al (2002/0083959) disclose a method for removing foreign matter from an object to be processed, wherein the foreign matter is removed by exposing the object to a fluid kept in a supercritical or subcritical state, the fluid dissolving the foreign matter (see claims). The inventive method is applicable to removing foreign matter from not only the dielectric film in a semiconductor device but also a conductor film or a semiconductor substrate in a semiconductor device or a component in a device of any other type. This is because the same effects may be attained in those cases under appropriate conditions [see paragraph 0089].

For example, an Mn film may be formed by using only $Mn(DPM)_2$ as a material for the metal organic film and reducing and dissolving $Mn(DPM)_2$ on the substrate with the reaction chamber kept in the supercritical or subcritical state in the presence of a reducing material such as carbon dioxide or a mixture of carbon dioxide and NH_3. The gate electrode of the MFISFET shown in FIG. 6(c) or that of an ordinary MIS transistor may be made of a metal such as aluminum or tungsten by doing so. Also, an MFMISFET may be formed by interposing a conductor film between the gate insulating film 28 and ferroelectric layer 29 and used as a nonvolatile memory device. In that case, the conductor film may be made of a metal such as Pt or Ir or a metal oxide such as IrO. By providing one of these conductor films, it is expected that the crystallinity of the ferroelectric layer 29 to be formed thereon would further improve [see paragraphs 0133-0134].

Vaartstra (6,242,165) discloses to remove organic material from a substrate with solvent in supercritical state. Wherein the substrate has doped and undoped semiconductors.

It would have been obvious at the time applicant invented the claimed process to incorporate the cited steps of cleaning the semiconductor having conductor and conductive layer with supercritical fluids as disclosed by Morita et al into the process of Inoue et al for the purpose of removing foreign material from the surface. Further, Vaartstra discloses to remove organic material from a substrate with supercritical fluids, wherein the substrate include doped and undoped semiconductors. Therefore, one of ordinary skill in the art would have used the teaching of Vaartstra into the process of Inoue et al for cleaning P or N doped regions. It is well known in the art to circulate the cleaning solution in the chamber to reach every components of

the substrate. Therefore, one would use a circulating step for exposing all the components of the substrate and remixing the solution in the chamber.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Saeed T. Chaudhry whose telephone number is (571) 272-1298. The examiner can normally be reached on Monday-Friday from 9:30 A.M. to 4:00 P.M.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. Michael Barr, can be reached on (571)-272-1414. The fax phone number for non-final is (703)-872-9306.

When filing a FAX in Gp 1700, please indicate in the Header (upper right) "Official" for papers that are to be entered into the file, and "Unofficial" for draft documents and other communication with the PTO that are for entry into the file of the application. This will expedite processing of your papers.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (571) 272-1700.

Saeed T. Chaudhry
Patent Examiner

MICHAEL BARR
SUPERVISORY PATENT EXAMINER